Library

Southwest FISHERIES CENTER

HONOLULU LA JOLLA MONTEREY TIBURON

REPORT OF ACTIVITIES May-June 1989

ANTARCTIC ECOSYSTEM RESEARCH GROUP Page

International Krill Meeting Held 1

COASTAL FISHERIES RESOURCES DIVISION

Sablefish Spawning Experiments Started 3

FISHERY-MARINE MAMMAL INTERACTIONS DIVISION

Special Aerial Survey Held of Harbor Porpoise in Monterey Bay in May 1989 11

HONOLULU LABORATORY

Honolulu Laboratory Hosts Workshop on Fish Aggregating Devices 13

PACIFIC FISHERIES ENVIRONMENTAL GROUP

23-Year Series of Wind Estimates Generated for Iberian SARP Study 18

PELAGIC FISHERIES RESOURCES DIVISION

First Quarter 1989 Statistics of U.S. Canned Tuna Industry Compiled 21

TIBURON LABORATORY

1989 Pelagic Juvenile Rockfish Survey Completed 22

INFORMATION TECHNOLOGY SERVICES

AIMS Project Initiated 23

PUBLICATIONS 24

SOUTHWEST FISHERIES CENTER

CENTER ADMINISTRATION- La Jolla, California

Science and Research Director, SWR ..... *Izadore Barrett*
Deputy Director ..... *John F. Carr*
Planning Officer ..... *David J. Mackett*
Information Technology Services ..... *Dorothy Roll*
Executive Officer ..... *Benjamin F. Remington*

LABORATORIES & DIVISIONS

Antarctic Ecosystem Research Group, Chief ..... *Rennie Holt*
La Jolla, California
Coastal Fisheries Resources Division, Chief ..... *John R. Hunter*
La Jolla, California
Fishery-Marine Mammal Interactions Division, Chief ..... *Douglas P. DeMaster*
La Jolla, California
Honolulu Laboratory, Director ..... *George W. Boehlert*
Honolulu, Hawaii
Pelagic Fisheries Resources Division, Chief ..... *Gary T. Sakagawa*
La Jolla, California
Pacific Fisheries Environmental Group, Chief ..... *Andrew Bakun*
Monterey, California
Tiburon Laboratory, Director ..... *Alec D. MacCall, Acting*
Tiburon, California

The Report of Activities of the Southwest Fisheries Center is compiled by the Technical Writing/Editing Group at La Jolla from material submitted by the Center's staff. To change the delivery address of the Report of Activities, or to cancel your subscription, please notify Lorraine C. Prescott , at P.O. Box 271, La Jolla, CA 92038. Telephone: (619) 546-7063.

ANTARCTIC ECOSYSTEM RESEARCH GROUP

La Jolla, California

The Southwest Fisheries Center hosted two international meetings on Antarctic krill in June. Highlights of the meetings are described below. Full reports are being prepared for distribution by the Executive Secretariat of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) in Hobart, Tazmania. Dr. Rennie Holt, AERG Chief, noted that "participation in these meetings gives us insight into the current understanding of the krill resource, the information needs of CCAMLR, and how the United States may best contribute."

International Krill Meeting Held

Krill biologists from the United Kingdom, Japan, South Africa, Australia, West Germany, Brazil, France and the United States convened in La Jolla to discuss simulation models of the fishery for krill in the southern ocean. Professor Douglas Butterworth, University of Cape Town, presented his model of the Japanese krill fishery and Professor Marc Mangel, University of California at Davis, presented his model of the Soviet fishery. Discussion focused on the utility of catch and effort data to construct indices of krill population abundance.

The workshop participants adopted a two-tiered description of the spatial distribution of krill. Krill are aggregated into 'swarms' and these swarms are distributed in different patterns or 'concentrations'. Concentrations of swarms were classified into three types: 1) small discrete swarms that are relatively dispersed, 2) discrete swarms contagiously distributed in clusters, and 3) extensive horizontal layers of animals distributed over a large area. It was also noted that large-scale krill distribution was infuenced by major bathymetric and hydrographic features.

The workshop contrasted the Soviet and Japanese fishing strategies. The Soviet strategy is to deploy survey vessels over large areas to locate fishable concentrations (types 2 and 3) which are then fished by catching vessels. The Japanese catching vessels operate more independently without the benefit of a survey vessel to locate fishable concentrations. Although the Soviet fishery is much more extensive than the Japanese fishery, both cover only a small portion of the southern ocean.

The workshop concluded that the data collected by the Soviet survey vessels could be used to estimate the number and size of krill concentrations, and that the data collected by the Japanese catching vessels could be used to estimate krill abundance within concentrations. It was emphasized that these estimates were only valid for relatively small well-defined areas.

Analyses were conducted at the workshop to assess the sensitivity of various indices to different types of change in krill abundance. These included changes in krill density within swarms, changes in the size of swarms, changes in the number of swarms per unit area within a concentration, and changes in the number of concentrations per unit survey area.

The workshop concluded that a composite index could be constructed from information on krill concentrations derived from Soviet survey vessels and on krill abundance within concentrations derived from Japanese catching vessels. This index, however, would only be meaningful for ecologically discrete areas of the southern ocean where both survey and catch data are available. More importantly, many of the component variables in the index do not change proportionately with abundance. Thus the index would not likely be sensitive to small changes in krill abundance, but any detectable change in the index would imply that a major change in krill abundance had occurred.

The workshop also concluded that certain within concentration parameters such as swarm size, number of swarms per unit area of concentration, and inter-swarm distances were best determined acoustically. The workshop recommended that specific data be collected by survey vessels operating in support of a fishing fleet and that catching vessels collect haul-by-haul data in a similar fashion as the current Japanese fishery. (R. Hewitt, FTS 546-7602)

CCAMLR Krill Working Group Considers Problems in Assessing Krill Abundance

The first meeting of the Krill Working Group was held in La Jolla following the workshop described above. At this meeting the Group, chaired by Dr. Denzil Miller of South Africa's Sea

Fisheries Institute, considered problems in assessing the abundance of krill in the ocean surrounding Antarctica. The Working Group was formed to provide advice to the Convention for the Conservation of Antarctic Living Marine Resources (CCAMLR).

The Working Group used the composite index constructed from krill catch and effort data as a departure point for their discussions. The relative merits of various methodologies for estimating krill abundance were debated and the following conclusions drawn.

Acoustic techniques:

1. Acoustic data (echo sounder returns, echo integration values, dual beam and split beam returns, and sonar returns) may be used to determine the number of krill concentrations and their size, the number of swarms within a concentration and their size, and the density of krill within a swarm.

2. Echo integration data may be used to estimate absolute abundance of krill in terms of numbers of animals or their biomass. The scaling factor, however, varies with the size distribution, behavior, and physiological condition of the krill detected. Of these, size has the greatest effect.

3. Size distribution data may be obtained from direct sampling by trawl or from *in situ* measurements of target strength using either dual beam or split beam acoustic techniques.

4. It is also possible to make a first approximation of krill biomass using only echo integrator data without a scaling factor.

Direct sampling by trawl:

1. No single net will adequately sample all size classes of krill. The known characteristics and problems associated with the nets most commonly used in the Antarctic were summarized by the Working Group. The unqualified use of nets to estimate krill abundance was not encouraged.

2. The Group recommended inter-net calibration experiments and the design of new nets to overcome or reduce the problems associated with net selectivity.

Other methods:

1. Cameras and remotely operated vehicles may be best used to calibrate the effectiveness of direct sampling methods or to investigate krill behavior and abundance under the ice edge.

2. Methods based on estimates of egg or exuviae production were considered impractical given the present knowledge of krill life history.

3. Estimating krill abundance from occurrence in the diet of predators is problematic for at least three reasons: 1) Krill life expectancy is currently a matter of debate; the longevity of krill is inversely related to production/biomass ratio and thus directly affects the estimates of abundance based on predator demand. 2) Predators may be opportunistic and change their diet in response to prey availability. 3) Predator response may be more related to local prey availability than overall prey abundance.

The Working Group discussed the various spatial scales of krill distribution, the methods appropriate to detect them, and the importance of measuring them. The Group concluded:

1. Global scale (>1,000 km) and macro scale (100-1,000 km) variations in krill abundance are not practical to measure given current methodologies. Available information on these scales is of limited value. Genetic studies to determine stock structure may be useful, however, in the development of management strategies. Also, large-scale historical surveys and fishing patterns should be examined for consistent broad patterns of krill distribution.

2. Patterns in sea surface hydrodynamics, detectable from satellite imagery, may be correlated with the distribution of krill concentrations. Currently available information should be analyzed.

3. Meso-scale (1-100 km) and micro-scale (0.01-1 km) variations in krill abundance are most readily investigated using current methodologies. Hydrographic and bathymetric features appear important to the formation and maintenance of krill concentrations on these scales. Analysis of acoustic data and fine-scale fishery data will be useful for additional information.

The Working Group noted that the annual catch of krill has remained constant over the last 3 years at approximately 400,000 mt, that 90% of the catch was taken from limited areas within the Atlantic sector, and that the fishery moves up the Scotia Arc from the Antarctic Peninsula to South Georgia as summer progresses to winter. Although the Working Group concluded that the current catch was not significantly impacting the krill population, they could not determine if the present level of fishing was having an adverse impact on local predators and recommended that the fishery not exceed the current level. (R. Hewitt, FTS 546-7602)

COASTAL FISHERIES RESOURCES DIVISION

La Jolla, California

CalCOFI Conference Planned

As the Coordinator for the California Cooperative Oceanic Fisheries Investigations (CalCOFI), Gail Theilacker completed and mailed the first announcement and call for papers for the annual Conference. This year CalCOFI celebrates its 40th anniversary, and a gala event is planned. The Conference will be held at Scripps Institution of Oceanography, University of California, at La Jolla, California, on October 25-27. The first 2 days will be verbal and poster presentations related to the biology, physics, chemistry, geology, meteorology, politics or economics of the California Current ecosystem and adjacent waters, and Eastern Boundary Currents. Additionally, the California Department of Fish and Game will summarize the status of fish stocks of commercial and recreational importance to the people of the Californias and their managers and legislators. The final day, the Anniversary Symposium of the Conference (organized by the Marine Life Research Group, Scripps Institution of Oceanography), will be on global change and the problems it may pose for society, emphasizing the role of the ocean. A multi-disciplinary panel of experts will discuss what society needs from oceanographers to prepare for global change.

Additionally, Theilacker reports that all the contributed and symposium manuscripts for the October 1989 volume of the CalCOFI Reports have been received, revised, and are in the hands of the Editor.

Summer visitor at the Coastal Division

Ian McCarthy, Ph.D student at the University of Aberdeen, Scotland, has been reviewing the literature on hormones and sexual maturation in fishes and assisting Theilacker with the sablefish maturation study.

COASTAL EASTERN PACIFIC POPULATION BIOLOGY OF FISHES

Sablefish Spawning Experiments Started

Gail Theilacker reports that she, Eric Lynn, and Larry Robertson are preparing to induce spawning in sablefish by using hormone implants. They are moving the fish into treatment groups, relining experimental tanks, building holding pens, and gathering needed materials.

Annual spawning in fishes is controlled by interactions between exogenous stimuli (changing environmental factors and behavioral cues) and endogenous stimuli (endocrine activity; pituitary-gonadal). At present in the SWFC aquarium, sablefish are maintained at more or less constant conditions: adequate food three time a week, low light levels during the day and dark at night, and temperatures ranging from 6-9°C. Over the last year, this regime has not produced a natural spawn nor maturation of eggs. However, some males have shown sperm.

To promote sexual maturation in sablefish, three experiments will begin this summer. The first experiment will control light wavelength and photoperiod, temperature, and salinity for a group of mature and immature fish maintained in a closed system. The second experiment will involve administering hormones on a monthly basis. Intermuscular implants (testosterone sealed in silastic tubing and luteinizing/releasing hormone in a cholesterol matrix) will be injected monthly into sablefish 57 cm or larger (size at 50% maturity) over the next 6 months. The third experiment, combining exogenous and endogenous stimuli, will control photoperiod for hormone-implanted fish.

NOAA Junior Fellow

Theilacker reports that Sean Costa, NOAA Junior Fellow, returned to work after an outstanding first year at Santa Cruz. This summer Costa will assist with the sablefish maturation study and participate on a CalCOFI Cruise. (G. Theilacker, FTS 893-7125)

COASTAL EASTERN PACIFIC FISHERIES ENVIRONMENTAL INVESTIGATIONS

Oceanographic Data from Sablefish Cruise Analyzed

Oceanographers Ron Lynn and Ken Bliss are completing a report of the physical oceanography measurements made on the SWFC/NWFC cooperative groundfish cruise aboard the NOAA Ship *Miller Freeman*, December 1988. Sixty-five CTD casts were made off the Oregon coast in conjunction with trawls and net tows. Although the usefulness of these data is limited by the extremely narrow spatial coverage and long time delays between CTD casts, they have been used to produce a descriptive summary of the vertical structure of waters over the continental slope. They have identified California Undercurrent water (centered near 180 m) and North Pacific Intermediate water (centered near 510 m) using the parameter spiciness, a function of temperature and salinity. The former has a maximum in spiciness (relatively warm and saline for its density) and the latter has a relative minimum. California Undercurrent waters are also identified by a relative minimum in dissolved oxygen and a large spatial variation in dissolved oxygen. These and other characteristics demonstrate a layering of water types influenced by differing sources.

The authors note that there are small-scale but significant vertical gradients in most stations as well as significant spatial variations between nearby stations that indicate dynamic activity to a depth of 750 m. The density structure, however, suggests that the geostrophic flow was very weak. Below that level the water characteristics form a common distribution pattern. In order to obtain some estimate of transport in future surveys, it will be necessary to cover a considerably larger area in a more timely manner. Even so, deep currents cannot be estimated with classical geostrophy. To obtain a record of deep total transport (a combination of geostrophic and baroclinic), it will be necessary to deploy a deep mooring of some modern and expensive instrumentation. (R. Lynn, FTS 893-7084)

ECOLOGY AND SYSTEMATICS OF FISHES (CalCOFI)

Cooperative SWFC and NWAFC Upper Continental Slope Groundfish Cruises Completed

The second of two cooperative groundfish research cruises was conducted aboard the NOAA Ship *David Starr Jordan* off Newport, Oregon, February 16-April 6, 1988. The initial cruise employed the NOAA Ship *Miller Freeman* in a survey of the same area, November 25-December 14, 1988. This report describes the activities of these cruises and presents preliminary data on the successful sampling of planktonic sablefish eggs during the second cruise.

The principal objectives of the cooperative groundfish research cruises were: 1) to estimate abundance of groundfish target species (sablefish, Dover sole, shortspine thornyhead, arrowtooth flounder, dark-blotched rockfish) using bottom trawl swept-area techniques; 2) to collect reproductive samples and data from target species taken in bottom trawls; 3) to sample the water column with a suite of three plankton nets (surface, 0-210 m bongo, full water-column bongo) to collect eggs of sablefish and test the possibility of using the egg production method in estimating spawning biomass of that species.

On the first cruise aboard the *Miller Freeman*, a NWAFC modified Nor'Eastern polyethylene high-rise bottom trawl with a 36.6 meter footrope was employed on 62 stations off Heceta Head (44°89'N) to Cape Lookout (45°21'N) at bottom depths of 100-700 fathoms. A total of 74 plankton net tows (27 surface, 27 surface-210 m, 20 full water-column) was taken. Approximately 142,000 fish of all species were collected and 3,000 specimens each of sablefish, Dover sole, and shortspine thornyhead were measured for length frequency analysis. Individual weights and otoliths were taken for 751 sablefish, 548 Dover sole, and 883 shortspine thornyheads. Several hundred fecundity samples were collected for each of these species and almost 1,000 maturity observations and tissue samples were taken for each of the three species.

Bottom trawl catch data were entered in the NWAFC (RACE) data base and work on fecun-

dity of target species is underway at the SWFC. Preliminary examination of the plankton samples shows no eggs or larvae of target species. Analysis of oceanographic data collected from a total of 65 CTD casts is in progress.

The cruise aboard the *David Starr Jordan* occupied the same station plan as the first cruise and employed both bottom trawls and plankton net tows. Two types of bottom trawls were used on the survey. The polyethylene high-rise Nor'Eastern net with a 36.6 meter footrope was used on the first 22 trawls. This proved to be too large for the vessel's winch system and a "Poly Aberdeen" trawl with a 27.4 meter footrope was used on the final 19 trawls. About 14,000 fish specimens were collected in the 41 trawls. As in the November-December cruise, extensive length frequency data were collected on sablefish, Dover sole and shortspine thornyheads. Also individual weights, otoliths, fecundity samples, and maturity data were collected for these species. Initial observations confirm that the cruise was well timed to coincide with the sablefish spawning season.

Plankton sampling was the major emphasis of the cruise. During the survey 59 surface (Manta) tows, 54 standard oblique bongo net (CALBOBL) tows to 210 m, and 46 full water-column bongo (DBOBL) tows were taken. The DBOBL tows were accomplished with a 61 cm bongo net to which a Plessy CTD was attached for monitoring and subsequent control of the tow path (see Dr. Paul E. Smith's description of the system in the March-April Report of Activities).

The highlight of the cruise was the occurrence of sablefish eggs in 70% of the DBOBL tows. A total of 220 sablefish eggs (actual count) occurred in 32 tows with a mean of 7 eggs per positive tow (range of 1-25 eggs). In addition to the positive DBOBL tows, 4 of the 54 CALBOBL tows each contained a single sablefish egg. The eggs occurred on the outer portion of the sampling pattern, consistent with the deep slope habitat of mature sablefish (Figure 1). The occurrence of nearly all eggs in the DBOBL tows is in agreement with unpublished data which indicate sablefish reside below 200 m (Dr. A. W. Kendall, Jr., NWAFC). The occurrence of single eggs in four shallow oblique tows in the region of Heceta Bank may relate to strong subsurface currents in this region which may have displaced the eggs to shallower waters.

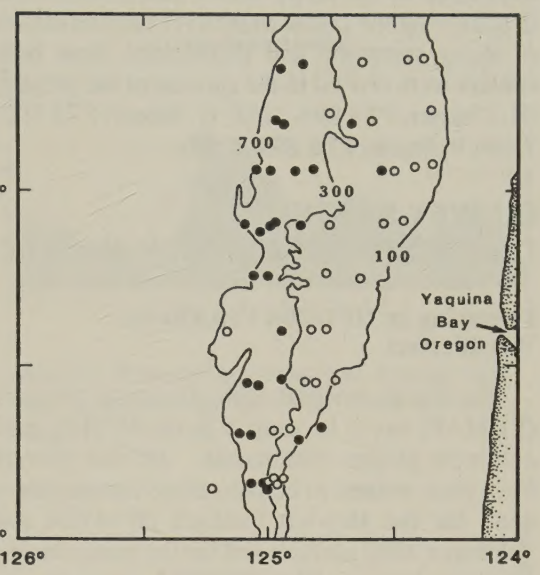

Figure 1. Occurrences (solid circles) of sablefish eggs in deep bongo net tows during cooperative SWFC-NWAFC cruise, February-March, 1989. Bottom depth contours in fathoms.

The high incidence and moderately large numbers of sablefish eggs taken during this survey suggest that the egg production method may be used to estimate biomass of sablefish. Clearly, the outer boundary of egg distribution was not defined (Figure 1) and this is corroborated by reports of sablefish eggs occurring seaward to at least 200 miles (Dr. A. W. Kendall, Jr., NWAFC). Future work must define in detail this onshore-offshore distribution of sablefish eggs before the efficacy of an egg production biomass estimation can be evaluated. Cruise plans for next year are presently being formulated with this as a principal objective.

Eggs of Dover sole were also collected during the cruise. A total of 529 (actual count) eggs occurred in all of these net types; 78% of these occurred in the Manta samples. Numbers of eggs captured in surface samples ranged from 1 to 149 with a mean of 17 eggs per tow. Frequency of occurrence and numbers per tow increased during the cruise and it was clear that the cruise coincided with the beginning of Dover sole spawning.

This first cooperative groundfish research survey was successful from a number of standpoints. In addition to the preliminary results mentioned above, many other research activities were accomplished on the two cruises and these will be reported elsewhere. The

dedication of the ships' crews was instrumental in achieving the cruise objectives and the efforts of many scientists and technicians from both centers were crucial to the success of the project. (R. Charter, FTS 893-7157; G. Moser, FTS 893-7129; P. Smith, FTS 893-7169)

SURVEY SYSTEMS DEVELOPMENT AND EVALUATION

Preparing an HP7470A Plot File for WordPerfect

The Environmental Data Mapping program (EDMAP) saves its output in an ASCII file of common plotter commands. Device drivers have been written to convert these commands to code for the Hewlett Packard HP7470A and Tektronix 4662 plotters and for the monochrome graphics screen. The HP7470A program was modified to send the code to a disk file, instead of to the plotter, and this file was imported into a WordPerfect document as a graphics insert. Figure 2 depicts a vertical time section of data obtained with an acoustic doppler current profiler, exemplifying the process. All it took was to access WordPerfect graphics with Alt-F9, and then select Figure, Create and Filename, in that order. WordPerfect loaded the file and obviously recognized the HP7470A code without any help. Location and size of the graphic box can be changed as desired by returning to the Alt-F9 menu and using the edit option. (L. Eber, FTS 893-7167)

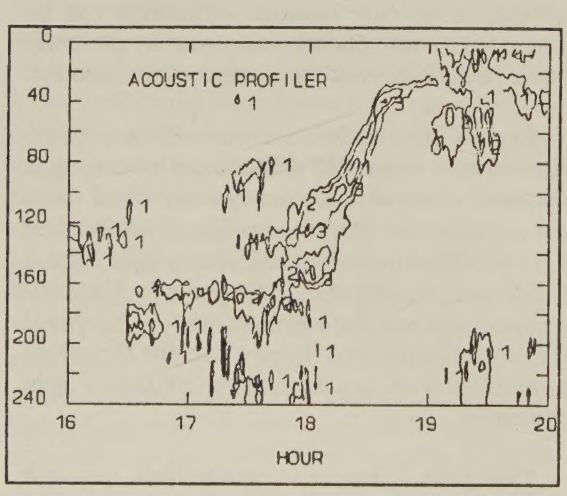

Figure 2. Acoustically detected biological aggregations in the southern California bight.

Spanish SARP

Dr. Nancy Lo, under the joint Spanish-North American project Sardine Anchovy Recruitment Project (SARP), assisted Spanish scientists in their estimation of spawning biomass of *Sardina pilchardus* of the Iberian Atlantic coast.

To provide a strong basis for the assessment and management of the sardine stock along the Atlantic coast in 1987, Spain and Portugal adopted the Egg Production Method (EPM; Lasker 1985) to estimate the spawning biomass. Cruises were conducted in February-May 1988 along the Atlantic coast. Lo was invited to help evaluate parameter estimation from egg and adult data by the Instituto Espanol de Oceanografia, Centro Oceanografico in Vigo, Spain from May 24-June 8. During her 2 week stay, Lo assisted scientists from Spain and Portugal with data checking, developing efficient ways to utilize data collected from both Spain and Portugal, stratification of survey area, parameterization and automation of methods to age sardine egg stages. All parameters required by the EPM for computing the spawning biomass were estimated. The results will be reported in the upcoming Spanish SARP meeting in October at La Jolla. (N. Lo, FTS 893-7123)

NURP Funds ROV Project

NOAA's Office of Undersea Research (OUR), National Undersea Research Program (NURP) has notified Dr. John Butler, Fishery Biologist of the Southwest Fisheries Center, that the proposal to develop habitat specific survey technology for demersal fishes using a Remotely Operated Vehicle (ROV) has been approved and funded. The ROV will be used in conjunction with a bottom trawl to calibrate the swept area trawl method and to survey rough bottom, which cannot be sampled by a bottom trawl. The ROV will be equipped with real time video cameras, survey cameras, and side-scan sonar. The cameras will be used to count fish in the path of the vehicle, the side-scan sonar will be used to count fish in the water column near the bottom. NOAA high resolution bathymetry data will be used to quantify habitat types to further improve the precision of biomass estimates. Butler is presently organizing a joint cruise in which one vessel will be operating the ROV and a chartered fishing vessel conducting the trawling. (J. Butler, FTS 893-7149)

COMMERCIAL AND RECREATIONAL FISHERIES RESEARCH FOR MANAGEMENT

Anchovy Biomass for 1989 Estimated

Management of the central subpopulation of northern anchovy (*Engraulis mordax*) includes a harvest quota which varies annually as a function of the estimated spawning biomass. The Southwest Fisheries Center provides the annual estimates of the spawning biomass that are used to determine the quota. This year's estimate was compiled by members of the Coastal Fisheries Resources Division (CFRD) staff, principally Dr. Larry Jacobson and Dr. Nancy Lo. Full documentation is available in SWFC Administrative Report, La Jolla, LJ-89-17.

The Stock Synthesis Model developed by R. Methot has been used on an annual basis since 1986 to estimate the spawning biomass of northern anchovy. The Stock Synthesis Model is an age-structured model that is parameterized such that indices of relative abundance computed by the model and age composition of the simulated catches agree with available data. Parameters in the model are estimated by means of a composite likelihood function.

The estimated spawning biomass for the central subpopulation of northern anchovy on February 15, 1989 was 237,000 mt which can be compared to 336,000 mt in 1988 and 583,000 mt in 1987 (Figure 3). The precision of the estimated value for spawning biomass is suspect, however, because the effects of water temperatures as cold as those observed during the 1989 spawning season on spawning rates, fecundity and the distribution of the spawning stock are unknown.

The estimated total biomass for northern anchovy on February 15, 1989 was 1,008,000 mt which can be compared to 369,000 mt in 1988 and 594,000 mt in 1987 (Figure 3). The increase in estimated total biomass was due primarily to the apparently large 1988 year class recruiting to the population (but not to the spawning stock) as 1-year-olds in 1989 (Figure 4). The precision of the estimated value for total biomass during 1989 is also suspect because it depends on the availability of young fish to the Mexican fishery at low water temperatures (which has not been precisely quantified) and on the atypical age

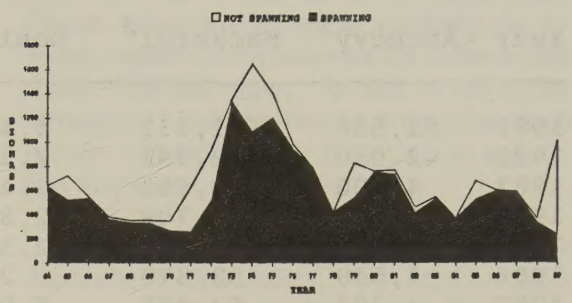

Figure 3. Estimated spawning stock biomass and total biomass during 1964-1989. Biomass values are given in units of 10^3 mt.

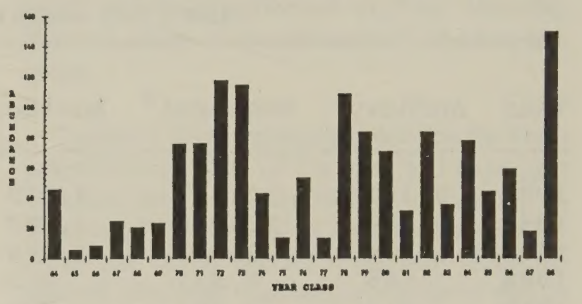

Figure 4. Estimated abundance (in units of 10^9 fish) of the 1964-1988 year classes at age 0 on July 1 (e.g. the abundance of the 1964 year class on July 1, 1964, was about 43 x 10^9 fish).

composition data for 1988. The apparently abundant 1988 year class and high total biomass suggest that the low spawning biomass was due primarily to the effects of cold water on the sexual maturity and spawning activity of 1-year-old fish and not due to recruitment failure or over-fishing. (L. Jacobson, FTS 893-7117)

Southern California Wetfish Fishery Status Report

Cynthia Thomson, Industry Economist, co-authored an Administrative Report (LJ-89-14) with Cedric Cooney (California Department of Fish and Game) and James Morgan (NMFS Southwest Region) entitled "Status of the California coastal pelagic fisheries in 1988." The report describes management programs, the commercial harvesting and processing sectors, and the recreational fisheries as they relate to the coastal pelagic species.

Statewide coastal pelagic landings in 1988 totaled 96,019 metric tons (mt) and had a nominal

Table 1. Annual landings (metric tons).

Year	Anchovy[1]	Mackerel[2]	Bonito	Squid	Sardine[3]	Total
1981	51,536	51,631	6,453	22,524	--	132,174
1982	42,050	52,983	2,325	16,240	132	113,730
1983	4,300	50,682	3,404	1,816	352	60,554
1984	2,905	52,709	2,802	564	238	59,218
1985	2,009	43,090	2,367	9,308	592	57,366
1986	1,548	52,878	240	21,280	1,188	77,134
1987	1,303	53,475	5,048	19,575	2,095	81,496
1988	1,468	50,188	3,938	36,640	3,785	96,019

Table 2. Ex-vessel revenues ($1000's).

Year	Anchovy[1]	Mackerel[2]	Bonito	Squid	Sardine[3]	Total	Total deflated[4]
1981	3,181	10,813	3,912	5,005	--	22,911	24,291
1982	2,124	10,480	1,087	3,590	26	17,307	17,307
1983	394	9,633	1,373	754	67	12,220	11,768
1984	665	9,531	832	305	43	11,376	10,558
1985	417	7,983	504	3,731	110	12,745	11,464
1986	274	8,590	83	4,882	215	14,044	12,265
1987	239	8,090	2,401	4,340	315	15,385	13,094
1988	367	8,082	1,695	7,944	582	18,670	15,342

[1]Includes both reduction and non-reduction landings, but not live bait catch.

[2]Obtained by subtracting estimated incidental landings of sardine from total mixed mackerel/sardine landings.

[3]The 1982-1985 figures pertain to sardines landed incidentally with mackerel. Because the State of California lifted its moratorium on sardines in 1986, the 1986-1988 figures include both incidental and directed fishery landings.

[4]Deflated GNP Implicit Price Deflator (Base Year=1982).

ex-vessel value of $18.7 million. Landings and revenues for 1981-88 are summarized in Tables 1 and 2. The landings and revenues in 1988 were significantly higher than the previous year largely due to the unprecedented squid harvest, which exceeded the previous record set in 1981 by 63%.

Incidental and directed sardine landings totaled 3,785 mt in 1988, an 81% increase over the previous year but still a modest proportion (4%) of total coastal pelagic landings. The directed quota was exhausted on July 11 in 1986, April 17 in 1987, and January 15 in 1988. This shortening of the season has been accompanied by an increase in the incidence of sardines in mackerel landings. Sardines comprised 1% of mixed landings in 1986, 3% in 1987 and 5.3% in 1988.

A total of 1,468 mt of anchovies were landed in 1988, 234 mt for reduction and 1,234 mt for pack-

aged bait. Given the low ex-vessel price and the availability of other target species, fishermen continued to show little interest in landing anchovy for reduction.

Live bait catch (all species), which is not included in the tables, reportedly totaled 5,043 mt in 1988. This figure underestimates actual catch because of delinquent fishing logs and because the amount of squid caught directly by commercial passenger fishing vessels for bait is not known. The species composition of the logged live bait catch was approximately 83% anchovy, 9% squid, and 8% other species (sardine, mackerel, white croaker, herring, queenfish, etc.).

Most of the coastal pelagic landings in the state are made by a fleet of small purse seiners based in San Pedro-Port Hueneme. This fleet also targets on tunas such as bluefin, yellowfin and skipjack. In the winter months of 1988-89 the fleet landed 139 mt of giant bluefin tuna that commanded a premium price on the Japanese sashimi market. Some of these fish weighed more than the previous California record of 237 kg (522 pounds) and the largest set a new record of 457.7 kg (1,009 pounds). This windfall, combined with revenues generated from the unusually large squid harvest, caused fleet revenues (net of inflation) to increase by 20% between 1987 and 1988.

Due to a large estimated spawning biomass in July of 1989, no quota will be imposed on Pacific mackerel in the 1989-90 season. The spawning biomass of northern anchovy in February of 1989 is estimated to be below 300,000 mt which, under the current Fishery Management Plan, causes a closure of the anchovy reduction fishery for the 1989-90 season. In 1989 the directed fishery for sardines closed on January 12, when the 726 mt (800 short ton) quota for ports south of Point Buchon was reached. The 181 mt (200 short ton) quota reserved for northern California was reached on April 6. Sea surveys are currently being conducted to estimate the sardine biomass for the 1990 season. (C. Thomson, FTS 893-7115

Continued Development of Economics Models for Pacific Coast Groundfish

Drs. Samuel Herrick, Jr. and Dale Squires, Industry Economists, have continued development of the positive quadratic programming model of the Pacific coast fishing fleet. These early stages of model development have focused upon a review of the literature and specifying the supply relationships for different fish species and gear types. Current efforts are devoted to specifying the ex-vessel demand relationships for the different fish species and gear types. As part of this effort, Herrick and Squires are reviewing the literature on demand and consumption theory and its application to fisheries.

Dr. John (Jack) Doll of the Department of Agricultural Economics, New Mexico State University at Los Cruces, has joined Herrick and Squires as a Summer Faculty Fellow. Doll formerly worked with the Northeast Center in Woods Hole, Massachusetts. He will concentrate upon implementing the positive quadratic programming model with GAMS (General Algebraic Modeling System), a high-level mathematical modeling language.

Squires is also continuing to develop the linear programming model of the trawl and fixed gear sablefish fleets. This model is to analyze the allocation of sablefish catch between the two different gear types. Squires is currently analyzing logbook data from Washington in order to specify the catch-effort relationships in the model. (S. Herrick, FTS 893-7111; D. Squires, FTS 893-7113)

FISHERY-MARINE MAMMAL INTERACTIONS DIVISION

La Jolla, California

PHOTOGRAMMETRY PROGRAM

On June 29, a meeting was held to develop ideas for ancillary projects using the data from aerial photographs taken from the helicopter for school size calibration. The meeting, convened by Andrew Dizon and Robin Westlake, involved members of the various tasks within the FMMID and was attended by Dizon, James Gilpatrick, Morgan Lynn, Stephanie Phibbs (NOAA Jr. Fellow) and Westlake (the members of the Photographic Remote Sensing Task [PRST]), as well as Jay Barlow, Susan Chivers, Doug DeMaster, Aleta Hohn, Mark Lowry, Al Myrick, and Stephanie Sexton. CDR Wayne Perryman, the previous leader of the group and developer of our

present experimental methodologies, who was visiting San Diego on leave from his duties as commanding officer of the FRS *Oregon II*, also attended the meeting.

Perryman provided the developmental history of the techniques we use and a summary of previous studies. DeMaster described how information requirements of the 1992 reauthorization hearings for the Marine Mammal Protection Act determine the priorities of the PRST. The panel then provided their ideas on what biological information, other than school size, can be extracted from the photographic images. Ideas ranged from measuring condition factors (girth) of migrating grey whales off the California coast (the photos were taken during previous training flights) to examining the effects of ship disturbance on school speed and dispersal.

Four projects were given high priority regarding the future hearings and will get underway immediately. These particular projects will be done on a collaborative basis with individuals from outside the photogrammetry and the PRST teams:

1. Using length distributions, a comparison will be made examining the fraction of calves in photos versus the fraction in kill and should provide an independent check on whether the kill values are likely biased.

2. Again using length distributions, the fraction of calves in the unexploited Costa Rican spinner schools will be compared with that in exploited eastern spinner schools and others. This may be a way to examine density compensatory responses in groups near and removed from their equilibrium population levels.

3. In some circumstances, when schools of spinner dolphins are encountered near the geographic boundary of the Costa Rican and eastern spinner stocks, the research vessel observers were uncertain as to which stock they were seeing. As a result, several schools were placed in the unidentified spinner stock category, reducing sample size in the analysis of abundance of the two stocks. Determination of the length distributions from the photographic images of the unidentified school will unequivocally distinguish the two because the Costa Rican spinner dolphin modal length is about 30 cm above the eastern dolphin length.

4. A comparison of observer and photo estimates of the percentage composition of mixed spinner and spotter schools will be made, again as an independent check of observer bias and precision in estimating the fraction of each dolphin species.

The PRST members were pleased with the interest of other Division members in becoming involved in joint research projects. The quality of the aerial photographs taken of both target species (spotted, spinner, striped, and common dolphin) as well as other cetaceans is so good, it would be a shame not to utilize this information source. The PRST invites other interested collaborators from within and outside the Center; please contact Robin Westlake who is coordinating ancillary studies. (A. Dizon, FTS 893-7089)

DOLPHIN STOCK ASSESSMENT PROGRAM

Monitoring Trends in Dolphin Abundance in the Eastern Tropical Pacific Using Research Vessels Over a Long Sampling Period: Analyses of First Three Years Data

In 1986, the NMFS initiated a long term (6 years) research program to monitor relative abundance of dolphin populations in the ETP. The program annually utilizes two research vessels for 120 days each. The research design for the surveys, presented by Rennie Holt, Tim Gerrodette and John Cologne (1987), would enable us to detect a 10% annual rate of decrease in northern offshore spotted dolphins (a total 41% decrease over six surveys) with alpha and beta error levels of 10%. They presented annual relative abundance estimates for the first 3 years of the program (1986, 1987, 1988). They also discussed various methods for calculating estimates and the various components of these estimates which still require further investigation. Although estimates are calculated for numerous species encountered, only those stocks most impacted by the tuna fishery (northern offshore spotted, eastern spinner and all stocks of common dolphins) are discussed herein.

Abundance estimates for the study area may be obtained using two different equations. Components may be calculated by regions (roughly defined by dolphin density and searching effort) within the study area and abundances summed over regions (equation 1), or data may be pooled over all regions to calculate components and

estimates (equation 2). Equation 1 is biased due to small sample sets, however it takes into account regional differences in components (i.e., density and school size varies significantly among the regions). Conversely, equation 2 is biased because it distorts the impact of regional differences, however it utilizes larger samples. To date, estimates calculated using equation 2 are more precise than estimates using equation 1; coefficient of variation (CV) for northern offshore spotted dolphin for 1988 was 0.16 using equation 2 and was 0.31 using equation 1.

To further investigate the effects of stratifying small data sets, we calculated estimates using two alternate methods which utilized equation 2 (pooled data). In method 1, abundance estimates were calculated using only data for each individual species. Although this method does not require calculation of estimates for each region, it still uses small data sets. Abundance estimates for 1986, 1987, and 1988 northern offshore dolphins using method 1 were 816 K, 1,210 K, and 1,332 K animals, respectively. Respective CVs were 0.289, 0.201, and 0.214.

In method 2, abundance estimates were calculated using all dolphin species. This method also may have been biased because of distortion among components by species, however , it maximized sample sizes. Abundance estimates for 1986, 1987 and 1988 northern offshore dolphins using method 2 were 924 K, 1,497 K and 1,456 K animals, respectively. Respective CVs were 0.164 and 0.158, and 0.184.

In summary, equation 2 appears to provide the most consistent estimates among years. Further, when using method 2, it also provides relatively precise estimates because it avoids using small samples. The bias attributed to coverage appears to be acceptable because the percentages of survey effort in the regions have remained relatively constant among years.

Estimates were also calculated for eastern spinner and common dolphins using equation 2 and method 2. Estimates for spinner dolphins in 1986, 1987 and 1988 were 546 K, 557 K, and 650 K, respectively. The respective CVs were 0.28, 0.19, and 0.22. Common dolphin estimates were summed over stocks and were inconsistent (1,379 K, 808 K and 3,796 K for 1986, 1987, and 1988). The respective CVs were 0.24, 0.28, and 0.23. The variation in estimates for common dolphins can be attributed to several factors, most notably an apparent increase in school size. These components are still being investigated for additional biases.

Further investigations of the effects of stratifying by regions will be completed when the aerial school size analyses are complete. We will also investigate several factors which may have contributed to differences observed between surveys. Estimates will also be examined for evidence of a trend, however, trend conclusions at this date are premature (survey design requires at least six consecutive estimates). (S. Sexton, FTS 893-7097)

COASTAL MARINE MAMMAL PROGRAM

Special Aerial Survey of Harbor Porpoise in Monterey Bay, May 1989

In the first few months of 1989, approximately 30 harbor porpoise are known to have died in Monterey Bay, based on counts of stranded animals and on direct observation of fishing boats. This apparently high level of fishery mortality prompted the California Department of Fish and Game (CDF&G) to implement a 120-day emergency closure which prohibited fishing with gill and trammel nets inshore of the 40-fathom isobath in major areas of Monterey Bay. In addition, Doyle Hanan (Project Leader, CDF&G) was directed to conduct a special aerial survey of harbor porpoise in the bay. The survey was carried out on May 11-12 with the help of Sandra Diamond (Marine Biologist, CDF&G), Jay Barlow (Research Analyst, NMFS), and Karin Forney (Computer Programmer, NMFS). Data from the survey were analyzed by Forney, and the resulting information was provided for a public hearing on May 18, during which the effects of the closure and continued regulations were discussed.

Previous aerial surveys have shown Monterey Bay to be an area of high harbor porpoise abundance--the number of porpoise seen per kilometer of survey in this area is roughly 2-3 times higher than the average for all of central California. The number seen during the May 1989 survey (0.064 porpoise/km) was slightly lower than in previous years (0.074, 0.131, and 0.090 for 1986, 1987 and 1988, respectively). This difference is probably not significant and could be due to a number of factors, including

small sample size, weather conditions at the time of survey, and time of year (previous surveys were conducted in the fall).

Based on her previous work with coastal contours (0-150 m depth), Forney was able to plot the approximate locations of harbor porpoise at the time of sighting in relation to water depth (Figure

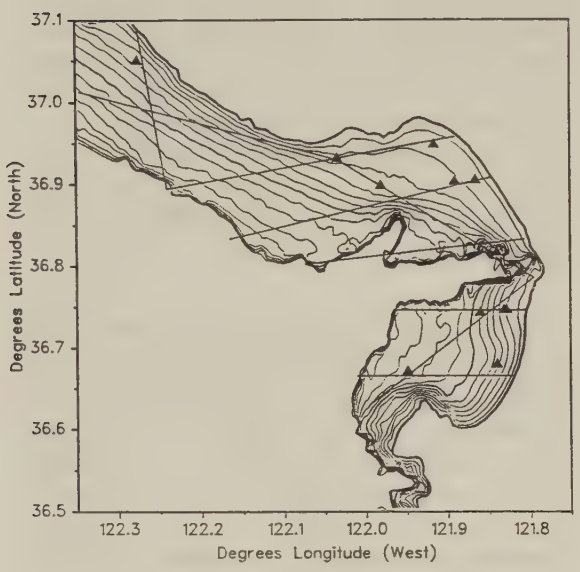

Figure 1. Transect segments flown (straight lines) and locations of harbor porpoise sightings (triangles) in Monterey Bay during May 1989 aerial survey. Depth contours are plotted from the coast to 150 m in 10 m increments. The thicker contour line at 70 m is roughly equivalent to the 40-fathom closure line.

1). Most of the May 1989 sightings (10 out of 12) occurred inshore of the 40 fathom contour, even though approximately 65% of the kilometers flown were over deeper waters. This figure is potentially misleading, however, because other factors are likely to play an important role in determining apparent harbor porpoise abundance (e.g. high Beaufort sea states tend to occur more often in deeper waters). Additional analyses of these data are planned. At the end of the 120 days, the closure will revert to 20 fathoms throughout the bay, and another hearing is scheduled for October. It is likely that the information from this survey will be important relative to future decisions. (K. Forney, FTS 893-7171)

Harbor Seal Radio-Tagging

Tiny radios were placed on six harbor seals as part of a continuing effort to study the movement patterns and hauling behavior of this species. The tagging took place in early June on several beaches between Santa Barbara and Point Conception, California. The tagging expedition was headed jointly by Dr. Jay Barlow (Operations Research Analyst, NMFS) and Doyle Hanan (Program Leader, CDF&G). The immediate goals of this project were to find out whether a new type of tag (the so-called sea otter flipper tag) could be used to monitor the behavior of seals during their molt and whether a rocket-propelled net could be used to capture seals. The long-range goals are to estimate the fraction of time that seals spend on the beach (in order to correct the survey data to account for seals in the water) and to determine the patterns of movements of seals (in order to determine their stock structure). Success with both the tagging and the capture methods make the attainment of these long-term goals seem feasible.

Barlow and Hanan were aided by a group of dedicated seal catchers, including Dr. Doug DeMaster (Wildlife Biologist, NMFS), Mark Lowry (Fishery Biologist, NMFS), Karin Forney (Computer Programmer, NMFS), Tim Ragen (UCSD), and Lisa Haberstroh, D.V.M. and Karen Smith (volunteers). The capture team proceeded first to Point Conception, where they found that the high tides prevented the safe deployment of the rocket net. Undaunted, they managed to catch four seals using the conventional method of sneaking close and then hoop-netting the seals. Seals "B", "C", "E", and "F" were captured, tagged with one radio on each of the two rear flippers, and released on June 2, 1989. A radio listening station was set up at Point Conception to continuously monitor the hauling behavior of seals on nearby beaches. Two of the seals ("B" and "E") hauled out again less than 4 hours after being tagged.

The team then moved their capture operation south to a site known as Dos Pueblos. Here they set out the 40'x 60' rocket net and waited for the seals to haul-out. Unfortunately, most of the seals were hauling at an area that could not be reached by the rocket net. The net was test-fired on the afternoon of June 3 when it appeared that two seals were within range. Although only one seal was actually captured in the net, the net deployed well and the same method could be used in the future to capture large numbers of seals. However, one rocket was lost which

precluded a second firing at that time. Seal "A", which was captured in the rocket net, was tagged with two radios and released. A group of approximately 20 seals hauled out at the same location the next morning (June 4) and the team was able to capture and tag an additional seal, "D". A second radio listening station was set- up and left at the Dos Pueblos site.

Data from the two radio-monitoring stations were downloaded to a lap-top computer on June 16 and again on July 3. Fresh batteries were installed at the same time. Each station had continuously monitored the presence of signals from the 12 radios that had been attached to the 6 seals for a total of 31 days (Figure 2). Seal "A" which had been tagged at Dos Pueblos was not present at either site until June 18, when it again began hauling out at Dos Pueblos. Seals "B" and "E" which had been tagged at Point Conception were frequently present at Point Conception. There was no sign of seals "C", "D", or "F" at either location except immediately after tagging.

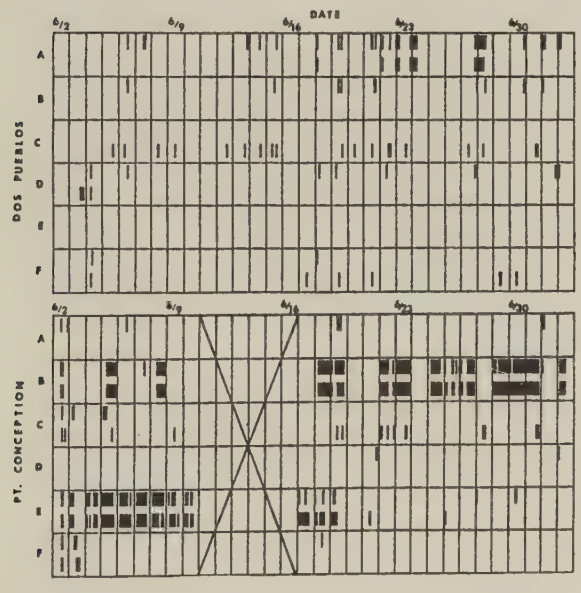

Figure 2. Solid bars indicate the presence of signals from the two radios on each of six seals (A through F). Recording stations are Dos Pueblos, CA (top panel) and Point Conception, CA (bottom panel). Wide bars which occur synchronously for both radios indicate the presence of that seal on the beach. Isolated narrow bars indicate radio-frequency noise. Only individuals A, B, and E were commonly present at these sites. Data from June 10 to 16 at the Point Conception station will require additional processing and is not included in the figure.

Three aerial reconnaissance flights were scheduled to find seals that were not found at the tagging sites. Barlow flew with CDF&G pilot Larry Heitz from Point Mugu to Point Arguello and out to San Miguel Island. During their first flight (on June 12), the missing seal "C" was located at San Miguel Island. On their third flight (June 20), they found the missing seal "D", also at San Miguel Island. In addition they heard the transmitters belonging to seals "B" (June 12) and "E" (June 13 and 20) at Point Conception. The latter is noteworthy because the radio- listening station at Point Conception did not pick up animal "E" on June 20.

Results from this radio-tagging study have already provided useful information for the management of seal populations. Movement of harbor seals between the mainland and the Channel Islands has been observed before, but it was not thought to be common. Although the disturbance of being captured and tagged may affect movement patterns, the observation of two seals moving from different mainland locations to San Miguel Island over such a short period of time is surprising. This may indicate that island and mainland populations are not independent.

This study has also shown the feasibility of radio-tagging seals during their molting season. In the past, radio tags have been attached to harbor seals by directly gluing the tag to their pelage. This could not be done during the molt because the pelage is constantly being lost. This study has shown that a radio attached to a flipper tag can be used to monitor the presence of seals on a beach. Additional work is planned using these types of tags and using the rocket net to capture seals. (J. Barlow, FTS 893-7178).

HONOLULU LABORATORY

Honolulu, Hawaii

Honolulu Laboratory Hosts Workshop on Fish Aggregating Devices

The Honolulu Laboratory hosted a strategic planning workshop on June 7-9, 1989, to assist the NMFS Office of International Affairs (OIA) and the U.S. Agency for International Development (U.S. AID) in designing fish aggregating device (FAD) fishery development programs for less-developed countries. Nine experts in the fields of

fishery economics, economic development, fishery biology, sociology, anthropology, and engineering contributed their ideas on barriers hindering the design and implementation of self-sustaining FAD programs. The participants also suggested activities that would help to overcome these barriers and recommended criteria for choosing sites for FAD deployment programs.

Some of the barriers considered by the participants were conflicts between users and the lack of the following: 1) mechanisms to generate FAD repair and replacement funding within such a program, 2) systems to track the costs and benefits of FAD's, 3) information about users, resources, and social and ecological impacts, and 4) on-site expertise, materials, and appropriate technology. Several criteria were identified for site selection including the prior existence of fishing activity using adaptable methods and boats, having access to distribution centers for receiving equipment and marketing products, the existence of aggregatable fish species in areas that would permit FAD moorings and not interfere with other activities, and the potential for direct involvement by the community or local government in FAD deployment.

The workshop was coordinated by Industry Economist Samuel G. Pooley and Fishery Biologist Christofer H. Boggs of the Honolulu Laboratory and facilitated by David J. Mackett from the La Jolla Laboratory. Among those attending the workshop were William Gibbons-Fly from the NMFS OIA and Chris R. Jones from U.S. AID. Proceedings of the workshop are forthcoming as an Administrative Report. (S. Pooley and C. Boggs (808) 943-1221)

INSULAR RESOURCES INVESTIGATION

Assessments of Bottom Fish and Groundfish Are Completed

The 1988 assessments of Hawaii's bottom fish and seamount groundfish stocks were recently completed by David A. Somerton, Leader of the Insular Stock Assessment Program, and Fishery Biologists Bert S. Kikkawa and Alan R. Everson. According to the assessments, the bottom fish fishery for snappers, groupers, and jacks continued to grow in 1988, and the estimated combined catch of all species from all areas (i.e., the main Hawaiian Islands and the Northwestern Hawaiian Islands (NWHI)) was the largest since 1984, when the sampling program was initiated at the Honolulu wholesale market. The increases in catch, however, were not realized equally in all areas.

In the NWHI, the catch of opakapaka, *Pristipomoides filamentosus*, the usual mainstay of the bottom fish fishery, was less than one-half of the 1987 catch. This decrease was accompanied by a geographic shift in fishing. Effort tended to be distributed more evenly among the various islands and banks. Another apparent shift occurred in target species--from the shallower group of species (opakapaka; hapuupuu, *Epinephelus quernus*; butaguchi, *Pseudocaranx dentex*) to the deeper group (onaga, *Etelis coruscans*; ehu, *E. carbunculus*). Coupled with the 15% decline in catch per unit effort (CPUE) that occurred in 1988, these changes suggest that the vessels can no longer focus on newly discovered "hot-spots" for opakapaka and that the "fishing-up" phase of the fishery is nearly over.

In the main Hawaiian Islands, the catch of uku, *Aprion virescens*, was 10 times higher than the 1987 level and apparently was the largest on record for the fishery. This phenomenal increase in uku catch is explained partly by a relatively large recruitment of small fish and by increases in availability and targeting by fishermen. The emphasis on this relatively shallow species resulted in increased catches of other shallow species and decreased catches of deeper species. For example, the catch of opakapaka was nearly double the 1987 catch, and this increase can be explained by the incidental catch on fishing trips that had clearly targeted uku.

Although optimality of the current bottom fish harvest cannot be addressed because of insufficient estimates of growth and mortality, it is still clear from weight distributions alone that the stocks in the main Hawaiian Islands have been subjected to a much higher exploitation rate than the NWHI stocks. For both opakapaka and ehu, fish caught in the main Hawaiian Islands are much smaller than in the NWHI (Figure 1). In addition, several species captured were largely immature. For example, about 57% of the opakapaka and 90% of the ehu captured in the main Hawaiian Islands were immature, compared with only 1 and 38%, respectively, in the NWHI.

Based on longline CPUE data obtained during research cruises, the abundance of pelagic armorhead, *Pseudopentaceros wheeleri*, on the

Southeast Hancock Seamount increased in 1988 after its record low in 1987. This increase was due to the recruitment of a strong year class. Over the 4 years of the stock assessment program, however, the population has not shown the sustained increase anticipated as the result of the current fishing moratorium (Figure 2). One possible reason is that the armorhead stock may constitute fish from all central Pacific seamounts rather than the Hancock Seamounts alone, and the commercial fisheries for armorhead are still occurring on these other seamounts.

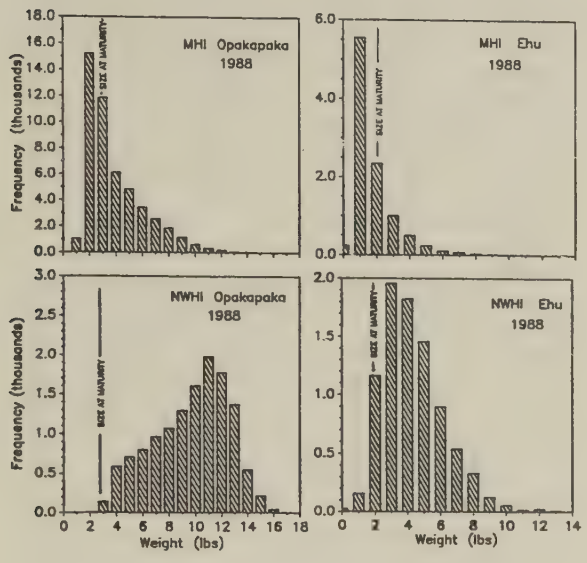

Figure 1. Weight-frequency distributions of opakapaka and ehu in the main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI) in 1988.

To obtain information on stock identification and the effects of fishing on the other seamounts, three of the Emperor Seamounts (Colahan, Kammu, and Koko) were sampled in addition to the Southeast Hancock Seamount in 1988. Armorhead CPUE's on the three Emperor Seamounts (31.4 fish per 1,000 hooks at Colahan, 7.1 at Kammu, and 14.3 at Koko) were considerably lower than on the Southeast Hancock Seamount (298.3 fish per 1,000 hooks), indicating that the fishing moratorium on the Hancock Seamounts has provided some protection. Two of the Emperor Seamounts (Colahan and Kammu) had armorhead that were similar in size and fatness to those at the Southeast Hancock Seamount, suggesting that they likewise experienced good recruitment in 1988 and probably comprised a unit stock with that on the Hancock Seamounts. The northernmost seamount sampled (Koko), however, had much larger fish than the other seamounts and appeared to lack recently recruited fish.

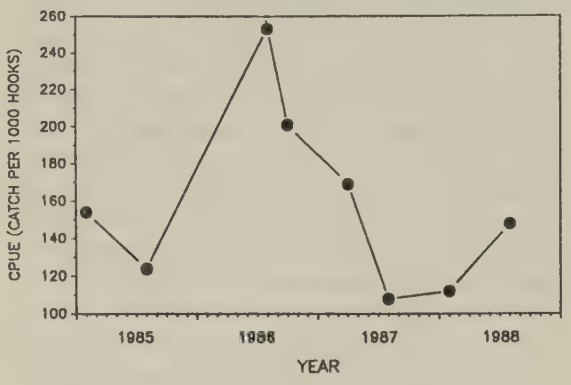

Figure 2. Research longline catch per hook of pelagic armorhead on the Southeast Hancock Seamount for eight stock assessment cruises in 1985-88.

The stock assessments were reported in "Biological assessment of the Hawaii bottom fish stocks and the Southeast Hancock Seamount armorhead stock, 1988" (SWFC Administrative Report H-89-6). (D. Somerton (808) 943-1259)

Benthic Shrimp Reared to Juvenile Stage

Deepwater caridean shrimp, *Heterocarpus laevigatus*, were reared to the juvenile stage in 139 days with 36 molts, by Fishery Biologists Thomas K. Kazama and Paul M. Shiota. The purpose was to determine identification of the early life stages of this species. The eggs were obtained from ovigerous females caught by trap fishing at about 600 m off the Island of Oahu. Differences in depth and temperature (3°-25°C) during capture did not appear to affect egg development. Viable larvae hatched even after 3 months of incubation at 3°-6°C.

Because little is known about the distribution of the larvae, rearing trials were conducted at 15°C and 22°-25°C to determine an optimal rearing temperature. The intermolt period increased with decreasing temperature. Larvae reared at the lower temperature took twice as long to attain a development stage as those reared at higher temperatures; larvae were not significantly larger at any stage. Rearing of the megalopic stage larvae was continued only at the higher temperature, until molt 35. Metamorphosis occurred on the succeeding molt after the larvae were transferred to 14°C. (T. Kazama and P. Shiota (808) 943-1221)

PELAGIC RESOURCES INVESTIGATION

User Manuals and Documentation Completed for Annual Report Preparation

User manuals and computer program documentation for preparing annual report modules on the status of the pelagic fisheries in American Samoa, Guam, Hawaii, and the Commonwealth of the Northern Mariana Islands (CNMI), were completed in June by Robert A. Skillman, Task Leader of the Pelagic Research Program, and Computer Programmer Reese Tokunaga contracted by the Western Pacific Regional Fishery Management Council (Council). The report modules are to be submitted by each island fisheries office and then used by the Council's Pelagic Plan Monitoring Team to prepare its annual report on the status of the managed pelagic fisheries.

The procedures consist of computer programs to process data on commercial landings and to produce tabular and graphics summaries to meet requirements listed in the Pelagic Fishery Management Plan (at least as interpreted by the Team). For American Samoa, Guam, and the CNMI, the computer programs are written in dBASE III Plus, whereas the programs for Hawaii are written in SAS. The procedures for graphics were developed with the software package CHART-MASTER to produce publishable-quality charts.

With the completion of these computer programs and graphing procedures, the fisheries offices in American Samoa, Guam, Hawaii, and the CNMI will be able to complete their own annual report modules with little or no support from the Southwest Fisheries Center and the Council. (R. Skillman (808) 943-1257)

FISHERIES OCEANOGRAPHY RESEARCH PROGRAM

Biology of Pomfrets from the Hancock Seamounts Studied

Results of a study by Fishery Biologists Michael P. Seki and Bruce C. Mundy on the early life history stages of pomfrets collected at the Hancock Seamounts (lat. 30°N, long. 179°E) were presented as a poster at the annual meeting of the American Society of Ichthyologists and Herpetologists, June 17-22, 1989. The Pacific pomfret, *Brama japonica*, has been identified as an underutilized fishery resource by Japanese researchers and is a significant part of the by-catch of the North Pacific Ocean drift gill-net fishery, currently of concern to NMFS biologists.

The collection of large larvae and juveniles of *B. japonica* at the Southeast Hancock Seamount supports the seasonal migration patterns suggested by Shimazaki and Nakamura (1981. Res. Inst. North Pac. Fish., Hokkaido Univ., Special Vol., p. 91-103). During the summer months, *B. japonica* occupy the "feeding grounds" in north Pacific subarctic waters above lat. 40°N. The species is then believed to migrate south to presumed spawning areas within the North Pacific Transition Zone and subtropical domain between lat. 25° and 40°N.

Larval and juvenile *B. japonica* (8.1-38.8 mm standard length (SL)) were collected over and away from the summit of the Southeast Hancock Seamount. All were collected in February 1985 and January 1988, except a 32.5 mm SL specimen which was collected in April 1987. This supports the findings of Yoon and Shimazaki (1981. Res. Inst. North Pac. Fish., Hokkaido Univ., Special Vol., p. 79-90), who, based upon gonadosomatic index values, predicted *B. japonica* to be multiple spawners during December through April and from early June to early July. Despite sampling at the seamount in summer 1987 and 1988, there is no evidence of the latter spawning period.

Collections of 11 bramid eggs and 77 smaller larvae near the seamount in February 1985 and January 1988 also supported the hypothesis of winter spawning of *B. japonica* in this region. Nine larvae (7.0-11.2 mm SL) were sufficiently developed to be identified as *B. japonica*, although differences between these and specimen collections from the La Jolla Laboratory's California Cooperative Fisheries Investigations cast some doubt on their identity. The eggs and smaller larvae could not be unequivocally identified, but most were probably *B. japonica* based on morphology, the proportions of juveniles in Honolulu Laboratory's collections, and known distributions of the adults. (B. Mundy (808) 943-1212)

FISHERY MANAGEMENT RESEARCH PROGRAM

Boat Club Gets the Facts about Longlining

A presentation on Hawaii's longline fishing industry was given before the Keehi Boat Club in Honolulu on April 14, 1989 by Samuel G. Pooley and Christofer H. Boggs. Approximately 40 club members attended the meeting. As indicated by their questions, club members were interested in the location and techniques of longline fishing and the impact of longline fishing on the availability of pelagic fishes (including yellowfin tuna, *Thunnus albacares*) to local trolling and handline fishermen.

Pooley and Boggs discussed the catch composition of Hawaii's fisheries, pointing out that the great majority of yellowfin tuna and blue marlin, *Makaira mazara*, are caught by trolling and handline methods and that the deep deployment of longline fishing gear results in catches composed mostly of bigeye tuna, *T. obesus*. (S. Pooley (808) 943-1216)

Assessment Completed on NWHI Lobster Fishery in 1988

A report by Fishery Biologist Raymond P. Clarke titled "Annual report of the 1988 western Pacific lobster fishery" states that the lobster fleet in the NWHI captured 889,005 legal spiny lobster, *Panulirus marginatus* (wet weight, 553 metric tons (t)), valued at $4.4 million and 168,607 legal slipper lobster, *Scyllarides* (wet weight, 85 t), valued at $0.6 million. Total ex-vessel revenue in 1988 was $5.0 million, up 25% from 1987. The three most important fishing grounds in terms of numbers of spiny and slipper lobsters caught were Maro Reef, Necker Island, and Gardner Pinnacles. A total of 9 federally permitted vessels took 28 trips and fished 845,182 trap-hauls in the NWHI in 1988.

The CPUE for legal spiny lobster reversed a 5-year trend by rising substantially from 0.49 in 1987 to 1.05 in 1988. However, total slipper lobster CPUE continued to decline from 0.59 in 1987 to 0.33 in 1988. The combined CPUE for legal spiny lobster and total slipper lobster rose 28% from 1987 levels. The seasonal distribution of catches indicates that spiny lobster CPUE peaks each year in about August, whereas slipper lobster CPUE peaks in April.

The ex-vessel price of frozen lobster tails dropped from record 1987 levels. Spiny lobster tails averaged $10.19/lb, and slipper lobster tails averaged $9.03/lb. However, live lobster prices continued to climb to about $7.50/lb. Economic analysis indicates that, despite the substantial drop in ex-vessel lobster prices, vessels on the average yielded positive returns on investments.

According to the report, the condition of the lobster stocks in 1988 appeared good, regulations were adequately protecting spawning biomass, and the catch and effort levels were within the confidence levels estimated for maximum sustainable yield (1.14 million legal spiny and slipper lobsters combined at a corresponding fishing effort of 848,000 trap-hauls).

Clarke's report was released as Southwest Fisheries Center Administrative Report H-89-5 and mailed to all lobster vessel permit holders in early May. (R. Clarke (808) 943-1213)

First Installation of Next Generation WPACFIN Completed

To increase data processing speed and capabilities, the Western Pacific Fishery Information Network (WPACFIN) is converting to an IBM-compatible environment after operating in the Apple II series environment since 1982, according to WPACFIN Program Manager David C. Hamm. The major system hardware and software are being purchased by the participating fisheries offices in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI), via other federal support funds such as the Interjurisdictional Fisheries Act and Dingell-Johnson. The WPACFIN Program is providing the training, data base and systems design, programming, and other technical support required to make the conversion.

Hamm traveled to Saipan in the CNMI in May 1989 to install the first IBM-compatible node in the field. Working with staff of the Division of Fish and Wildlife (DFW) in Saipan, Hamm installed a number of computers and printers recently purchased by the DFW. Hamm also connected three existing computers to the peripheral sharing network. A major part of the installation process was introductory training on the new hardware and software, including MS-DOS, CHART-MASTER, dBASE IV, and the networking software. Additional training will be provided by WPACFIN

during a 2-week workshop tentatively scheduled for September 1989 in Honolulu. (D. Hamm (808) 943-1214)

Annual Report Modules Completed for Two Fishery Management Plan Monitoring Teams

David C. Hamm, Program Manager of WPACFIN, completed six annual report modules in June 1989, presenting the status of the bottom fish and pelagic fisheries in American Samoa, Guam, and the CNMI. Annual reporting on the status of these fisheries is required by the Council's Fishery Management Plans (FMP's), and Plan Monitoring Teams have been established to coordinate the development of these annual reports, to assess the fisheries, and to make recommendations to the Council if management actions are needed.

For the past 2 years, Hamm has been acting as the Team representative for American Samoa, Guam, and the CNMI at the request of their fisheries offices, because they were not ready to assume these new federal responsibilities. As part of his responsibilities, Hamm coordinated the development of six of the annual island reports for the Teams' 1988 reviews of the bottom fish and pelagic fisheries. These six reports summarized fisheries data from the three island areas for 1979-88.

Some of the tables and figures for the pelagic species reports were produced by a contractor for the Council, but all other processing was completed within the WPACFIN Program. A newly appointed Team member from American Samoa wrote the first draft of the Samoa bottom fish report, using tables and figures provided by WPACFIN. Newly appointed Team members from Guam and the CNMI reviewed the draft reports developed by Hamm and WPACFIN Computer Programmer Michael M. M. Quach.

Progress is being made to transfer all Team responsibilities to the newly appointed Team members from the three island areas so they can produce future annual reports without direct assistance from WPACFIN. To that end, a major first step was recently taken when the newly appointed Team members from each of the three island areas represented their fisheries offices for the first time at Team meetings held in Honolulu on 30-31 May 1989. (D. Hamm (808) 943-1214)

PACIFIC FISHERIES ENVIRONMENTAL GROUP

Monterey, California

FISHERY/ENVIRONMENTAL LINKAGES

23-Year Series of Wind Estimates generated for Iberian SARP Study

A file of estimates of wind speed and direction at nine locations in the northeastern Atlantic Ocean have been generated at 6-hour intervals for the period 1967 to the present. The basic data are the archived wind/pressure analyses produced at the U.S. Navy's Fleet Numerical Oceanography Center (FNOC). A simplified approximation of planetary boundary layer effects is used to convert the wind estimate appropriate for the geostrophic layer to one representative of conditions near the sea surface (i.e. mast height).

The data will be used to interpret the results of the recent "Iberian" Sardine Anchovy Recruitment Project (SARP) in which scientists from the U.S., Spain and Portugal participated. SARP is one of the focal projects of the International Recruitment Program (IREP) which is co-sponsored by the Intergovernmental Oceanographic Commission and the Food and Agriculture Organization of the United Nations under their collaborative program of Ocean Science in Relation to Living Resources (OSLR). The file of wind data will be used to test the hypothesis that turbulent mixing events, related to short-term intense storms, can disrupt survival of early larvae by dispersing fine-scale accumulations of minute food organisms needed for successful larval feeding. The data file has been transmitted to Paul Smith of the Southwest Fisheries Center, La Jolla, who will be lead investigator for the analysis. (A. Bakun (408) 646-3311)

PHYSICAL OCEANOGRAPHY

Collaboration With U.S. Naval Postgraduate School in Comparative Ocean Modeling

PFEG has a continuing interest in comparative studies of ecosystem dynamics within eastern ocean boundary upwelling

regions. Because of limited staff and resources, it is sometimes advantageous to enter into collaborative arrangements with other institutions whereby PFEG data products are provided for use in research projects and field investigations. Benefits to PFEG include "feed-back" evaluations and calibrations of the PFEG products, insights as to their proper interpretations, research results of mutual interest, etc. Accordingly, seasonal wind patterns and time series indicators of interyear wind variability are being provided to scientists at the Naval Postgraduate School (NPGS) for use in modeling efforts addressing the evolution of fluid motions in three regional settings: 1) off central California, 2) off Baja California, and 3) off Spain and Portugal.

The models developed at NPGS have been shown to generate realistic mesoscale eddy fields which are typical of the flow patterns observed in these regions. PFEG collaboration to date has involved production of seasonal data fields, and also time series indicators of interyear variability, of momentum input to the ocean by the wind in all three areas. The differing coastal orientations, coastal and sea floor topographies, and characteristic wind patterns among the several regions, are expected to produce differing features in the model results that will help to sort out the actions of the various mechanisms involved. For example, the Iberian Peninsula features a rather straight meridional coastline which is strictly bounded to the north and south and has a similar cyclonic wind stress curl pattern to that existing off Alta California. The Baja California situation has the unique feature that anticyclonic wind stress curl, typically confined to regions some hundreds of miles offshore, characterizes a substantial portion of the near-coastal region. Comparisons of the model results will help to interpret the consequences of interyear variability of wind stress curl to advection and diffusion processes in eastern ocean neritic ecosystems. (A. Bakun (408) 646-3311)

PELAGIC FISHERIES RESOURCES DIVISION

La Jolla, California

MULTISPECIES DATA COLLECTION AND EVALUATION PROGRAM

Seychelles Purse Seine Fishery Data

Al Coan, Mathematical Statistician, reports that data for purse seiners fishing in the area around the Seychelles for the first quarter of 1989, have been received from the Seychelles Fishing Authority and added to Center data bases. The data bases are available on PC diskettes and are in LOTUS spreadsheets.

The first quarter of the 1989 fishing season was dominated by vessels from France (20 vessels) and Spain (20 vessels). Also participating in the fishery were vessels from the USSR (4), Mauritius (3), Panama (1), and Japan (1). The logbook coverage rate so far in the first quarter is approximately 85%. Total catches of yellowfin and skipjack tunas (60,280 mt), during the first quarter of 1989, increased 38% over catches during the same period in 1988. The percentage of skipjack and yellowfin tuna in the catch was 53% and 46% respectively. This species composition is unusual for this time of the year; usually yellowfin tuna is the dominant species in the catch (27% skipjack and 72% yellowfin recorded during the same period in 1988).

Catch rates increased from approximately 21 mt/day fished in January to 37 mt/day fished in March of 1989. In comparison with 1988 (18 mt/day fished in January and 17 mt/day fished in March) these catch rates are higher. (A. Coan, FTS 893-7079)

STOCK ASSESSMENT AND FISHERY IMPACT ANALYSIS PROGRAM

Eleventh North Pacific Albacore Workshop Held

The Southwest Fisheries Center hosted the 11th North Pacific Albacore Workshop on May 18 and

19 at the Center. Twenty-eight participants from Canada, Japan, France, the South Pacific Commission, Taiwan and the United States presented 19 working papers and several information papers relating to the condition of the stock and the associated fisheries. Considerable new data and analyses were made available for scientific review.

The assessment of the condition of the North Pacific albacore stock was different and more pessimistic than determined by previous workshops. Several sets of new data pointed to the likelihood that the stock has experienced recruitment failures in at least two recent years. Further, new analyses of catch-per- effort (CPUE) indicators suggest that the adult stock may be at the lowest level seen in recent years. Both major surface fisheries (Japan and U.S.) show long term declines in CPUE and effort with very low values for recent years. The workshop concluded that the combination of declining CPUE and effort in fisheries which monitor the young stock, and the unknown but possibly high incidental mortalities on small fish from the drift net fisheries for other species, i.e. squid, and the apparently missing or much-reduced abundance of two year-classes, suggest that the stock may be experiencing recruitment problems.

The workshop participants noted that environmental events may have contributed to the problems associated with the stock. A number of recommendations were adopted centering on confirmation of the condition of the stock and increased monitoring of the missing year-classes as they move through the fisheries. (N. Bartoo, FTS 893-7073)

Thresher Shark Fishery

The 1989 thresher shark fishing season ended on May 31 with a disappointing total landing of 160,000 lbs. This is approximately half of the 1988 landing for the California fishery, and continues the downward trend since 1982 (Figure 1). This low landing contributed to passage of California legislation that terminates directed fishing for thresher sharks with drift gill net (DGN). However, landing of incidental catches by the commercial DGN fishery for swordfish will still be allowed. The incidental catch is expected to amount to about 320,000 pounds, which is small compared to last year's total catch of 605,000 pounds and the 5-year average of 1.38 million pounds.

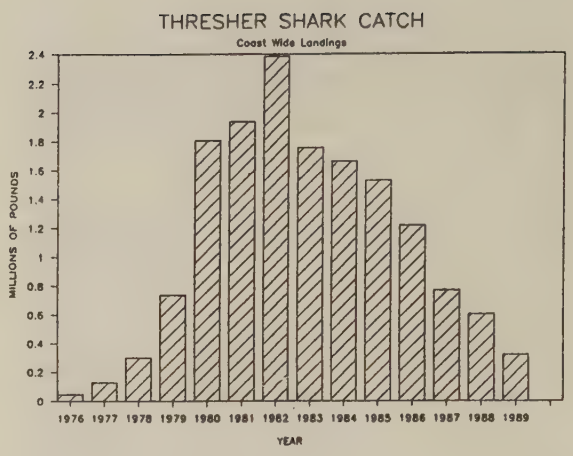

Figure 1. West coast thresher shark catch, 1976-1989.

The thresher shark fishery went through a tremendous expansion in the late 1970's, peaked in 1982 at nearly 2.5 million pounds and has been in decline ever since. The fishery operated off Oregon and Washington under an experimental gear permit beginning in 1987. Both Oregon and Washington, however, have recently terminated issuing permits due to decreasing catches and fears that fishing pressure on this coastal pelagic stock is excessive for maintaining a healthy stock.

The immediate need for a more precise assessment of stock condition, includes obtaining foreign catch data, and continued monitoring of the California swordfish DGN fishery for incidental catch-effort data, length frequency data and other biological information. These data are currently being collected by cooperating parties. Concurrently, a fishery management plan is being prepared by the Pacific Marine Fisheries Commission. (D. Holts, FTS 893-7186)

Analysis of Tuna-Associated Species Completed

Before 1976, U.S. porpoise observers recorded species of large animals that co-occurred in tuna sets made by purse seiners in the eastern tropical Pacific. The fishery targets on free-swimming schools of tuna, and tuna associated with floating logs and porpoise schools. Although the data are not collected in a uniform way, sufficient information is available to allow characterization of the allospecies associates of

yellowfin tuna in log, school, and porpoise sets. Fishery Biologist David Au recently completed a review of the data and an analysis of associated species. A total of 1,762 tuna set records collected during 1974 and 1975 were reviewed. Sharks were the most common in association with tuna, co-occurring in up to 90% of log sets. The overall average for log sets was 40%, representing mainly silky sharks, and 10% in porpoise sets of mainly whitetips. Most other nektonic animals associated with tuna schools averaged in the 10% or less range. These include manta rays in log and school sets, billfish in all set types, turtles, and bullet and black skipjack tunas in some sets, especially in log sets. Dolphin fish (mahimahi) were relatively common in log sets at 24%.

Most sets, especially porpoise sets, were also associated with birds: boobies, shearwaters, terns, and frigatebirds. A significant number of school sets was associated with shearwaters and terns, and a significant number of porpoise sets was sighted with boobies and frigate birds. These results are consistent with the hypothesis that tunas increase their foraging speed in oligotrophic waters to maximize their prey encounter rate and hence, are associated with the faster sea birds, shearwaters and terns. A manuscript has been prepared describing these associations in terms of behavior within communities. A companion paper on the avifaunal characteristics of differently foraging tuna is in progress. (D. Au, FTS 893-7071)

FISHERY MONITORING AND EVALUATION PROGRAM

First Quarter 1989 Statistics of U.S. Canned Tuna Industry Compiled

Statistics of the U.S. canned tuna industry in the first quarter of 1989 were recently compiled by Wes Parks and Diane Pickelsimer, SWFC, and Pat Donley and Mike Thabault, SWR. A report describing the statistics will appear as an article in the August 1989 issue of the SWR/SWFC Tuna Newsletter.

Sixty-three vessels of the U.S. tropical tuna purse seine fleet were at sea at least one day during the first quarter of 1989, down five vessels from the number active in the first quarter of 1988. Total capacity at sea was down 5%.

Receipts of all tuna species totaled 124,630 short tons (st) at U.S. canneries during the first quarter of 1989, up 5% from both first-quarter 1988 and the recent long-term (1984-1988) average (Table 1). Deliveries in the first quarter from domestic sources, were up 3% from 1988 and imports were up 7%.

Table 1. U.S. cannery receipts (st) of domestic and imported raw tuna by species in the first quarter of 1989 and 1988 and the recent (1984-1988) average. ALB = albacore, SJ = skipjack, and YF = yellowfin tuna.

Year	Source	Species ALB	SJ	YF[1]	Total
1989	Domestic	1973	26468	21188	49629
	Imported	26373	27479	21149	75001
	Total	28346	53947	42337	124630
1988	Domestic	1454	21058	25751	48263
	Imported	22397	31081	16531	70009
	Total	23851	52139	42282	118272
Avg 84-88					
	Domestic	316	25606	29132	55054
	Imported	22768	25831	15285	63884
	Total	23084	51437	44418	118938

[1]Includes a small amount of bigeye, blackfin and bluefin tuna.

Tuna delivered to U.S. canneries in the first quarter of 1989 originated principally in the western Pacific Ocean. Eight nations provided more than 90% of the raw, frozen tuna imported to U.S. canneries in the first quarter of 1989. Major suppliers were Taiwan, South Korea and Venezuela.

Imports of canned tuna to the U.S. in first quarter 1989 were 7.2 million standard cases, and exceeded both 1988 imports and recent long-term (1984-1988) average imports. Imports from three nations, Thailand, the Philippines and Taiwan, contributed more than 90% of U.S. canned tuna imports in the first quarter of 1989. For details see the August issue of the Tuna Newsletter. (W. Parks, FTS 893-7074)

TIBURON LABORATORY

Tiburon, California

GROUNDFISH COMMUNITIES INVESTIGATIONS

Methods Developed to Identify Juvenile Rockfishes

The occurrences of juvenile rockfishes, *Sebastes* spp., in the diets of predators have proven to be reliable indicators of relative year-class strength. A persistent problem inherent in this method, however, has been identifying specimens in which diagnostic features have been damaged by digestion. To reduce this problem, Fishery Biologists Wayne Samiere and Kelly Silberberg, of the Groundfish Communities Investigations, have developed means to identify certain species using bony structures that resist digestion. They began by examining many variably digested specimens to determine which structures best resisted digestion. These were then taken from specimens of known identity, mounted and stained with Alizarin red. Based on close examination of material prepared this way, they have found that the last vertebra and hypural (tail) bones will distinguish the most frequently occurring species--*Sebastes jordani*, *S. entomelas*, *S. mystinus*, and *S. saxicola*. They have also found that the cleithrum (one of the bones supporting the pectoral fin) can be used to identify *S. paucispinis* and *S. pinniger*, and to make the particularly difficult distinction between *S. entomelas* and *S. flavidus*. (P. Adams, FTS 556-0568)

GROUNDFISH PHYSIOLOGICAL ECOLOGY INVESTIGATIONS

GPEI Collects Juvenile Yellowtail Rockfish for Assessment of Condition

The Groundfish Physiological Ecology Investigations collected juvenile yellowtail rockfish during the May and June Rockfish Recruitment Assessment cruise. As summarized in the last bimonthly report, our goal was to assess their physiological condition and to relate condition to environmental and maternal variables. This study, together with others being conducted on adults may help elucidate the factors affecting recruitment.

Catches of juvenile yellowtail rockfish were highest in the Cordell Bank transects, and sufficient samples were collected to satisfy the sample size needs for several measurements of condition. Although no obvious diseases, parasites, abnormalities, or pathology were seen grossly, samples are now being examined further for morphometrics, gross abnormalities, parasite burdens, mesenteric fat, total lipid concentration and energetic lipid to structural lipid ratios, total protein, RNA/DNA, calorimetry, stomach contents, and liver histochemistry. Research on liver histochemistry will be done cooperatively with Dr. David Hinton, School of Medicine, School of Veterinary Medicine, University of California at Davis.

Those characteristics varying in relation to environmental and parental variability in fish from Cordell Bank will be selected for next year's juvenile sampling and for further study in the laboratory.

Drs. Jeannette Whipple and Maxwell Eldridge attended the Japan- U.S. Cooperative Seminar held in Honolulu, Hawaii on June 26-30. The seminar, organized by Dr. George Boehlert, Director of the Honolulu Laboratory, was entitled "Rockfishes of the Genus *Sebastes*: Their Reproduction and Early Life History." Eldridge presented the following paper: Eldridge, M.B., J.A. Whipple, M.J. Bowers, B. Jarvis and J. Gold. Reproductive performances of yellowtail rockfish (*Sebastes flavidus*). (J. Whipple, FTS 556-0569)

GROUNDFISH ANALYSIS INVESTIGATIONS

1989 Pelagic Juvenile Rockfish Survey Completed

The staff of the Groundfish Analysis Investigations at the Tiburon Laboratory has recently completed its annual survey of the young-of-the year (YOY) pelagic rockfish (*Sebastes* spp.). The purpose of the survey was to determine the distribution and abundance of juvenile rockfish inhabiting the nearshore waters off the central California coast between Monterey Bay (Monterey County) and Point Reyes (Marin County). The month long cruise was conducted aboard the NOAA Ship *David Starr Jordan* from May 12 to June 15. The sampling design involved making three sweeps of the area using a Seabird CTD instrument during

the day to gather temperature and salinity data and trawling at night with an 80' headrope midwater trawl with 3/8" liner to capture the juveniles.

Cruise Leader David Woodbury and Chief Scientist William Lenarz report that although the abundance of juvenile rockfish was low (2,500 fish), much important information was gathered. All stations were sampled and additional information was gathered on the occurrence of juvenile rockfish within offshore upwelling jets. Although the analyses of the data are still in progress, preliminary results indicate that recruitment was very poor. These surveys began in 1983, a strong El Niño year, when reproduction was virtually a failure. This year's sampling resulted in the lowest abundance of juveniles found since 1983. This was also true for juveniles of other fish taxa, as well as invertebrates. Catches of adult fish (i.e. anchovy, hake, etc.) were low, but not to the same degree.

Oceanographic conditions, which are felt to play an important role in the survival of young pelagic fish, bore some similarity to those experienced in 1983. This year, warm sea-surface temperatures were recorded in the spring and the upwelling season, which produces cool, nutrient-rich water, was delayed until nearly mid-May. Although not caused by an El Niño, these warm waters, in addition to the late onset of upwelling, could be responsible for the low abundances. The relationship between oceanographic patterns and rockfish recruitment is of primary concern and will be studied more closely.

In addition to the studies of the Groundfish Analysis Investigations, specimens and data were collected for the following research projects during the cruise: 1) juvenile yellowtail rockfish were collected from Cordell Bank by Michael Bowers and Elizabeth Norton of the Groundfish Physiological Investigations, Tiburon laboratory; 2) Dover sole juveniles and eggs were collected for the La Jolla laboratory; 3) juvenile Pacific whiting were collected for the NWAFC, Seattle Laboratory; 4) fish and invertebrates were collected for the NMFS, Systematics Laboratory, Washington, D.C.; 5) fish and invertebrates were sampled for a pollution study by Brian Melzian, US EPA, San Francisco, CA; 6) adult Pacific herring were collected for the California Department of Fish and Game; 7) juvenile sanddabs were collected as master's thesis material by Keith Sakuma, San Francisco State University; 8) several aquaria were used by Joe Luczkovich (Humboldt State University) to study the behavior of pelagic-staged juvenile rockfish; and 9) sea bird distribution and abundance was monitored by Peter Pyle and Ian Gaffney, Point Reyes Bird Observatory. (D. Woodbury, FTS 556- 0565)

INFORMATION TECHNOLOGY SERVICES

AIMS Project Initiated

The Administrative Information Management System (AIMS) project began with the meeting on May 31 to establish the organization planning committee to plan, design, write, test, and implement an integrated administrative management system for the Southwest Region (SWR). The pre-planning group team, Gary Smith and Ron Scheltens (SWR) and Ben Remington, Dorothy Roll, and facilitator Dave Mackett (SWC), identified the following objectives for AIMS: efficiency, data accuracy, timely reports, and cost savings through single entries affecting multiple files and ready access of time and attendance data for FRS, personnel, etc. They discussed the options to be included in AIMS and agreed that the owner of AIMS is Charles Fullerton, who will approve and authorize critical changes to the master plan, and that Iz Barrett and Gary Smith are the operational decision makers for the master plan. They selected the core members for the AIMS Planning Committee: Ben Remington, Ron Scheltens, Barbara Engstrand, and Virginia Hostler (prime users of the administrative system), Robert Bistodeau and Jerry Hornof (technical representative for the Center and Region), chairperson Dorothy Roll and facilitator Dave Mackett.

The AIMS Planning Committee held their first meeting on June 12. They reached a consensus on the objectives of AIMS and identified a list of tasks required to establish a developmental plan. The 29 tasks identified will be organized into a preliminary PERT chart. The logic of the preliminary activity chart will be reviewed during a July meeting. Based on task time estimates and task types, the committee members will be assigned specific tasks. (D. Roll, FTS 893-7057)

ITS Expands Support Services

Matthew (Matt) D. Bones joined the ITS staff on May 22, 1989. Matt is an experienced electronics technician, formerly a civilian employee with the Navy's Audio Visual Main-

tenance shop in North Island, San Diego, CA. Currently, in the evening hours he teaches an electronics class at Coleman College in San Diego.

As the electronics technician, he expands the technical services offered by ITS. His primary tasks are to assist the scientific and technical staff in interfacing shipboard and land-based data collection devices with microcomputers, and in troubleshooting computer hardware problems and software interface problems. In addition, he will provide and maintain the cabling and linkage of segments to work stations and associated peripherals for the La Jolla Laboratory's 3COM Local Area Network (LAN) system. (D. Roll, FTS 893-7057)

PUBLICATIONS

Published

Holt, Rennie S. and Stephanie N. Sexton. 1989. Report of the marine mammal survey of the eastern tropical Pacific aboard the research vessel *David Starr Jordan* July 28-December 6, 1988. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC- 129, 141 p.

Husby, David M., Robin D. Muench and John T. Gunn. 1989. Oceanographic observations in the Scotia Sea marginal ice zone, June-August 1988. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-127, 19 p.

Perrin, William F. and Jerry V. Kashiwada. 1989. Catalog of the synoptic collection of marine mammal osteological specimens at the Southwest Fisheries Center. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-138, 18 p.

Parrish, Richard H., Norman W. Bartoo, Samuel F. Herrick, Jr., Pierre Kleiber, R. Michael Laurs and Jerry A. Wetherall. 1989. Albacore management information document. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-126, 52 p.

Polovina, Jeffrey J. 1989. Density dependence in spiny lobster, *Panulirus marginatus*, in the Northwestern Hawaiian Islands. Can. J. Fish. Aquat. Sci. 46:660-665.

A positive linear relationship between the ratio of natural mortality to von Bertalanffy growth and catch per unit effort (CPUE) and a negative relationship between asymptotic length and CPUE were observed for the spiny lobster, *Panulirus marginatus*, among seven banks in the Northwestern Hawaiian Islands prior to the development of a fishery (1977-81). Resampling two of these banks in 1986-87 after heavy fishing indicated an increase in the asymptotic length and a decrease in the length at onset of egg production.

Sexton, Stephanie N., Rennie S. Holt and Alan Jackson. 1989. Report of a marine mammal survey of the eastern tropical Pacific aboard the research vessel *McArthur* July 28-December 6, 1988. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC- 128, 136 p.

Approved by Science and Research Director, SWR

Boehlert, George W. [Book review.] Sinclair, Michael. Marine populations: An essay on population regulation and speciation. For publication in Books in Recruitment Fishery Oceanography. Univ. Wash. Press, Seattle, 252 p. (1987)

Harman, Robert F., and Michael P. Seki. *Iridoteuthis iris* (Cephalopoda, Sepiolidae): New records from the central North Pacific and first description of the adults. For consideration for publication in Pacific Science.

Polovina, Jeffrey J. Evaluation of hatchery releases of juveniles to enhance rockfish stocks. United States-Japan Cooperative Seminar on Reproduction and Early Life History in the Genus *Sebastes*, Honolulu, HI 96822, June 26-30, 1989.

Perrin, William F. Subspecies of *Stenella longirostris* (Mammalia: Cetacea, Delphinidae). For publications in the Proceedings of the Biological Society of Washington.

Pitman, Robert L., David W. K Au, Michael D. Scott and James M. Cotton. Observations of beaked whales (Ziphiidae) from the eastern tropical Pacific Ocean. For consideration for publication in the Report of the International Whaling Commission (Special Issue).

Smith, Susan E. and Norman J. Abramson. Leopard sharks (*Triakis semifasciata*) distribution, mortality rate, yield, and stock replenishment estimates based on a tagging study in San Francisco Bay. For consideration for publication in Fishery Bulletin, U.S.

Administrative Reports

Hamm, David C., Michael M. C. Quach, Reese Tokunaga, Fini Aitaoto, Gerald W. Davis, and Terry J. Donaldson. 1989. Review of the 1988 pelagic fisheries of American Samoa, Guam, and the Com-

monwealth of the Northern Mariana Islands. SWFC Admin. Rep., Honolulu, H-89-7, var. pag.

Hamm, David C., Michael M. C. Quach, Fini Aitaoto, Gerald W. Davis, and Terry J. Donaldson. 1989. Review of the 1988 bottomfish fisheries of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. SWFC Admin. Rep., Honolulu, H-89-8, var. pag.

Hanan, Doyle A., John Scholl and Sandra Diamond. 1989. Harbor seal, *Phoca vitulina richardsii*, census in California, May- June, 1988. SWFC Admin. Rep., La Jolla, LJ-89-13, 56 p.

Jacobson, Larry D. and Nancy C. H. Lo. 1989. Spawning biomass of the northern anchovy in 1989. SWFC Admin. Rep., La Jolla, LJ- 89-17, 22 p.

Laurs, R. Michael and Robert Nishimoto. 1989. Summary of South Pacific albacore tagging conducted during 1986-1989. SWFC Admin. Rep., La Jolla, LJ-89-15.

Laurs, R. Michael and Robert Nishimoto. 1989. South Pacific albacore catch made by U.S. jibboats during the 1987-1988 and 1988-1989 fishing seasons. SWFC Admin. Rep., La Jolla, LJ-89-16.

Reilly, Stephen B. 1989. Report of a Workshop on Estimating Mortality of Dolphins in the Eastern Tropical Pacific U.S. Tuna Fishery. SWFC Admin. Rep., La Jolla, LJ-89-12.

Somerton, David A., Bert S. Kikkawa, and Alan R. Everson. 1989. Biological assessments of the Hawaii bottom fish stocks and the Southeast Hancock Seamount armorhead stock, 1988. SWFC Admin. Rep., Honolulu, H-89-6, 34 p.

Thomson, Cynthia, Cedric Cooney and James Morgan. 1989. Status of the California coastal pelagic fisheries in 1988. SWFC Admin. Rep., La Jolla, LJ-89-14, 20 p.

Translation

Nakamura, Yoshikazu. 1988. Distribution and maturity of neon flying squid, *Ommastrephes bartramii* (Lesueur), in the surrounding waters of Izu-Ogasawara Islands in spring. Bull. Hokkaido Reg. Fish. Res. Lab. 52:139-149. (Engl. transl. by W. G. Van Campen, 1989, 15 p., Transl. No. 131; avaiable Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96822-2396.)

UNITED STATES
DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
SOUTHWEST FISHERIES CENTER
8604 LA JOLLA SHORES DRIVE
P.O. BOX 271
LA JOLLA, CALIFORNIA 92038

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
DEPARTMENT OF COMMERCE
210

THIRD CLASS